16183

Ceramic Material and Nondestructive Evaluation/Test (NDE/NDT) Needs for Future Vehicle Platforms

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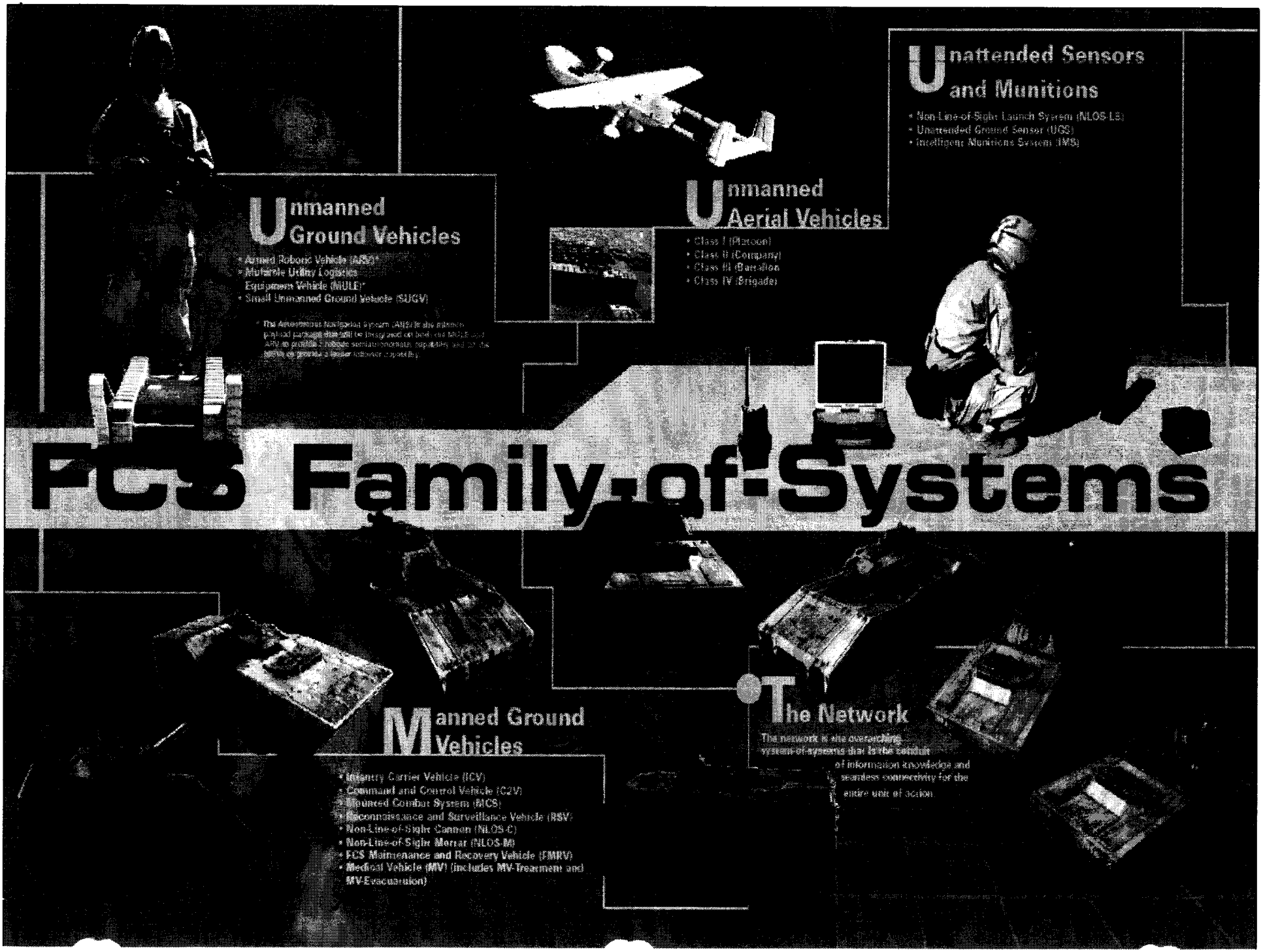
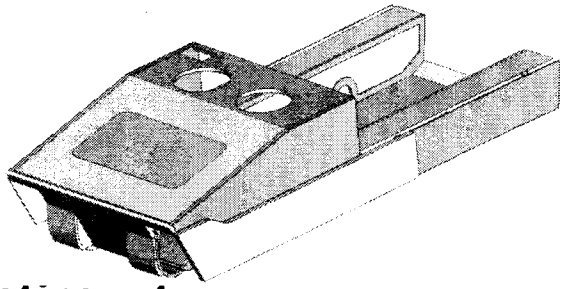

Unattended Sensors and Munitions
• Non-Line-of-Sight Launch System (NLOS-LS)
• Unattended Ground Sensor (UGS)
• Intelligent Munitions System (IMS)
Unmanned Aerial Vehicles
• Class I (Platoon)
• Class II (Company)
• Class III (Battalion
• Class IV (Brigade)
Unmanned Ground Vehicles
• Armed Robotic Vehicle (ARV)*
• Multi-role Utility Logistics Equipment Vehicle (MULE)*
• Small Unmanned Ground Vehicle (SUGV)
* The Autonomous Navigation System (ANS) is the advanced payload package that will be integrated on both the MULE and ARV to provide a robotic semi-autonomous capability and on the latter to provide a leader-follower capability.
FCS Family-of-Systems
Manned Ground Vehicles
• Infantry Carrier Vehicle (ICV)
• Command and Control Vehicle (C2V)
• Mounted Combat System (MCS)
• Reconnaissance and Surveillance Vehicle (RSV)
• Non-Line-of-Sight Cannon (NLOS-C)
• Non-Line-of-Sight Mortar (NLOS-M)
• FCS Maintenance and Recovery Vehicle (FMRV)
• Medical Vehicle (MV) (includes MV-Treatment and MV-Evacuation)
The Network
The network is the overarching system-of-systems that is the conduit of information knowledge and seamless connectivity for the entire unit of action.

Future Vehicle Platform

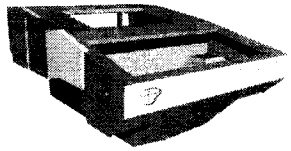
Requirements Definition

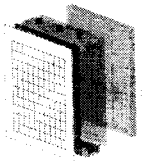


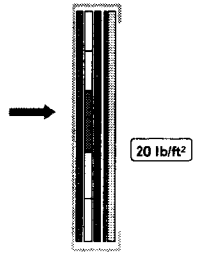
- **Lightweight**
- **Structurally Capable System Platform**
- **Blast, Kinetic, and Energetic Threat Capable**
- **Serviceable and Repairable**
- **Upgradeable and Spiral Development Friendly**
- **Other: EMI Shielding, Low Flammability, Heat Dissipating, etc.**

Structures/Armor Technologies & System Design

- **Low Cost Titanium**
- **Low Cost High Strength Aluminum**
- **Blast Dampening Composite Structures**
- **Ceramic/Polymer Composite Materials**
- **Ceramic/Titanium Materials**
- **EM Armor &/or other Energetic Threat Soluti**
- **System Integration Methods**
- **Standard Approach to Transition**







Mfg Technologies & MTO Project Plan

Armor Manufacturing Technology Objective (MTO)

- Funded Program (FY03 – 09) $120M
- Integrated Process Team (IPT)
  - *RDECOM/INDUSTRY*
  - *Boeing/GDLS/UDLP*
- Identify Manufacturing Technology Research
  - Transition to Production for Future Vehicle Platform

Manufacturing Challenges (FY04-09)

- Joining Major Structural Sections of Different Materials i.e. Composite & Metallic
- Integration of Ceramic Armor on Structure
  - Tile Confinement
  - Bonding Tiles to Composite & Metallic
- Metallic Portion of Structure Fabrication Less Significant
  - Still Investigate Unique Joining & Inspection Techniques
  - High Productivity Machining Techniques

Structure IPT Status

- Vehicle Platform Concept in Development
  - Composite floor, mine driven
  - Metallic sidewalls (Ti or Al)
  - Ceramic tile for ballistic protection
  - Mission module (s)
- Composite and/or Metallic
- Material Trade Study in Process

Structural Armor Estimates

- Ceramic Tile Requirements
  - Common Chassis with Mission Module
  - 3K to 5K lbs per vehicle
- Program Requirements
  - Vehicle Production Example

2006	2007	2008	2009	2010	2011	2012	2013
32	31	1	79	78	191	294	588

- *First year 96,000 – 160,000 lbs*

Ceramic Needs Future Vehicle Platforms

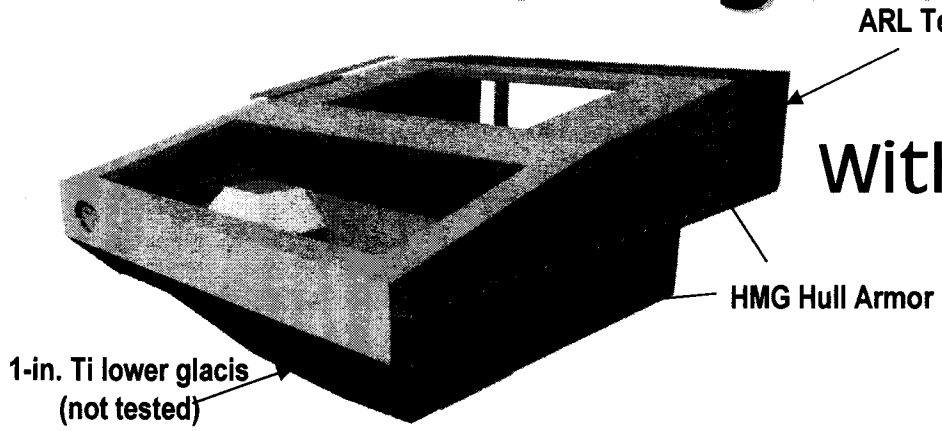
- Cercom Inc. PAD SiC-N Best Performing Material to Date
- Ceramic Tile Manufacturing Challenges
  - Continuous rather than batch processing
  - Production capacity
  - Inspection technique (s)
  - 60% cost reduction
- Focused Effort within Armor MTO to Meet Ceramic Mfg Challenges

Inspection Techniques for Ceramic Tiles

- Silicon Carbide (SiC)
  - Standard 4" x 4" x 1"
  - Processing Defects

Background Slides

FCS-X1 Survivability Configuration



With RO/RO Hull Armor

With Integrated & Add-on Armor